

## National Institutes of Health SBA-Approved SBIR/STTR Topics for Awards over Statutory Budget Limitations

1/1/2015

NIH has received approval from SBA for the topics listed within for budgets greater than \$225,000 for Phase I SBIR/STTR awards and greater than \$1,500,000 for Phase II SBIR/STTR awards for 2015. Applicants are **strongly encouraged** to contact NIH program officials prior to submitting any award budget in excess of these amounts. Applicants are also required to follow NIH Institute- and Center-specific budget guidance found in all SBIR and STTR funding opportunity announcements.

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## **NATIONAL CANCER INSTITUTE (NCI)**

- A. Therapeutics (e.g. Small Molecules, Biologics, Radiomodulators, and Cell-based Therapies)
- B. *In Vitro* and *In Vivo* Diagnostics (e.g. Companion Diagnostics and Prognostic Technologies)
- C. Imaging Technologies (e.g. Agents, Devices, and Image-Guided Interventions)
- D. Devices for Cancer Therapy (e.g. Interventional Devices, Surgical, Radiation and Ablative Therapies)
- E. Agents for Cancer Prevention (but not “Technologies for Cancer Prevention”)
- F. Development of Low Cost Technologies for Global Health
- G. Development of Companion Diagnostics
- H. Vaccine Development for Cancer Prevention
- I. Novel Technologies to Address “Undruggable” Drug Targets

## **NATIONAL CENTER FOR ADVANCING TRANSLATIONAL SCIENCES (NCATS)**

- A. Innovative platforms for identification and prioritization of targets for therapeutic intervention with clear clinical impact
- B. Technologies to determine alternative uses for existing therapeutic interventions
- C. Tools and technologies to allow assaying of activities of compounds on currently “non-druggable” targets
- D. Phenotypic assay development, including stem cell technology platforms for human “disease in a dish” applications and the evaluation of toxicity
- E. Co-crystallization high-throughput screening techniques
- F. Small molecule and biologics analytical characterization
- G. Tools and technologies that increase the predictivity or efficiency of medicinal chemistry, biologic, or other intervention optimization
- H. Accelerate bioengineering approaches to the development and clinical application of biomedical materials, devices, therapeutics, and/or diagnostics
- I. Tools and technologies that increase the efficiency of human subjects research, including development of technologies that facilitate rapid diagnosis and/or clinical trial recruitment and subject tracking, IRB evaluation, and/or regulatory processes
- J. Novel platforms, technologies and tools to enable clinical and translational research, particularly those with mechanisms for inclusion of patient reported data
  
- K. Searchable access to information about researchers and their expertise, including but not limited to their publications, published data sets, methods, patents, clinical trials, partnerships, collaborators, and clinical specialty/expertise (if applicable)
- L. Tools for meaningful sharing of research data with low barrier for provision and user friendly access
- M. Searchable access to information about research resources, facilities, methods, cells, genetic tests, molecules, biologic reagents, animals, assays, technologies with links to their use in published research studies

## **NATIONAL CENTER FOR COMPLEMENTARY AND INTEGRATIVE HEALTH (NCCIH)**

- A. Biomarkers which correlate with efficacy of complementary health approaches.
- B. Standardized, reliable and economical tools and methods that correlate with complementary health approaches.
- C. Formulation and development of IND-approved complementary health approaches.
- D. Identification and prioritization of associated with biological targets for pain relief from complementary health approaches.
- E. Safety and mechanistic aspects of natural product-drug interactions.
- F. Non-traditional phenotypic assay development for complex natural product mixtures.
- G. Integrated *in silico* tools for exploiting the natural product bioactivity.

# **NATIONAL EYE INSTITUTE (NEI)**

## **General Research and Development Topics**

- A. New or improved ophthalmic or surgical instruments for diagnosis and treatment of eye disorders.
- B. Drug delivery systems; gene therapy, cell-based therapy or regenerative medicine;

## **Retinal Diseases**

- A. New therapeutic approaches for inflammatory and degenerative diseases and for inhibition of abnormal angiogenesis in the retina and choroid

## **Corneal Diseases**

- A. Therapeutic agents and drug delivery methods for the treatment of corneal injury, infection, dry eye, ocular pain, and other ocular surface disorders

## **Lens and Cataract**

- A. New approaches in the management of cataracts

## **Glaucoma and Optic Neuropathies**

- A. New therapeutic agents for treatment of glaucoma

## **Visual Impairment and Blindness**

- A. New or improved devices, systems, or programs that meet the rehabilitative and everyday living needs of blind or visually-impaired persons

## **NATIONAL HEART, LUNG, AND BLOOD INSTITUTE (NHLBI)**

- A. Biomedical technologies (medical devices, instruments, pharmaceuticals, drugs, therapeutics, vaccines, diagnostics and biologics) for heart, lung, blood, and sleep related diseases and disorders requiring Federal regulatory approval (FDA) or clearance to be commercialized.
- B. Small and large animal testing of products of tissue engineering and regenerative medicine, drugs, medical devices, therapeutics, and biologics and studies involving *in vivo* animal experiments for heart, lung, blood, and sleep related diseases and disorders.
- C. Clinical trials and other experiments involving human subjects for heart, lung, blood, and sleep related diseases and disorders.
- D. Therapeutics (drugs, devices, or biologics) development for heart, lung, blood, and sleep related diseases and disorders.
- E. Device development for heart, lung, blood, and sleep related diseases and disorders
- F. Diagnostics development for heart, lung, blood, and sleep related diseases and disorders.
- G. Investigation of biomarkers and biosignatures of heart, lung, blood, and sleep related diseases and disorders.
- H. Technologies to enhance clinical research for heart, lung, blood, and sleep related diseases and disorders.
- I. Advanced instrumentation and high throughput tools for biomedical research in heart, lung, blood, and sleep related diseases and disorders.
- J. Tools and platforms to improve the dissemination and implementation of evidence-based interventions for heart, lung, blood, and sleep related diseases and disorders.

## **NATIONAL HUMAN GENOME RESEARCH INSTITUTE (NHGRI)**

- A. Development of novel or significant improvements on current next generation sequencing technology
- B. Bioinformatics software for genomic, genetic and sequence data analysis, functional genomics and genomic data integration
- C. Genomics tools ranging from new instruments to sophisticated molecular biology kits
- D. Incorporating genomic results into electronic medical records
- E. Informatics tools that assist in delivering genomic medicine to patients
- F. Single cell genomic analysis



## **NATIONAL INSTITUTE ON AGING (NIA)**

### **Division of Behavioral and Social Science (DBSR)**

- A. Development and translation of behavioral economics approaches (incentives or disincentives) to motivate sustainable behavior change to improve health and well-being.
  - 1. Increasing levels of physical activity or promoting treatment adherence
  - 2. Addressing biases such as loss aversion, errors in affective forecasting, present bias, ambiguity effect, base-rate neglect, and susceptibility to framing effects in health and financial decision making
  - 3. Using information, or the mode of data presentation to systematically improve decision making (e.g., through “nudges,” policies, or practices that constrain choices)
- B. Development of robotics applications to aid elderly
  - 1. Socially assistive robots allowing elderly to remain independent in their homes. Technology could support machine cognition, language understanding and production, human-robot interaction (cognition, perception, action control, linguistics, and developmental science), perception, and systems.
  - 2. Use of robots to promote social interaction and engagement and reduce loneliness among the elderly;
  - 3. Use of robots to motivate elderly to exercise.
- C. Development of cognitive training applications/intervention to improve cognitive function in elderly
  - 1. Rapidly develop novel, engaging computer-based cognitive training programs that are based on efficacious approaches and which use cognitive training to target a specific neural system/functional domain.
  - 2. Augment existing computerized cognitive interventions to be personalized, engaging, adaptive, sufficiently challenging, and optimal for maximizing real world functional improvements.
- D. Development of blood-spot technology for biological data collection:
  - 1. Development of multiple and reliable assays for limited blood-spot specimens for large surveys.

### **Division of Biology of Aging**

- A. Effects of metabolism on the aging process, e.g., how metabolic regulation influences longevity, and the development of anti-oxidants or other interventions to reduce oxidative or other stresses and aging-related diseases.
- B. Development of minimally-perturbing techniques for collecting blood from mice, rats, and other animals several times a day in sufficient quantities for measurement of hormone levels and other circulating factors in young and old non-human animals, or development of non-invasive research and test methods for use in non-human animals.
- C. Development of interventions that improve the immune response to foreign molecules or reduce the response to self or suppress age-induced inflammation.
- D. Development of novel strategies for treating age-related renal, pulmonary, urology, reproductive disorders, and age-related changes in hormone production and function, including devices, pharmacological targets and their validation, small molecules and other approaches to treat these

disorders in the elderly; early-stage pharmacological validation of novel targets and accompanying pre-therapeutic leads for these age-related diseases are encouraged.

- E. Development of novel methodology for treating osteoarthritis, including devices, processes and pharmacological agents with the potential to: (1) slow the rate of joint deterioration, (2) promote the remodeling of damaged joints, (3) reduce the likelihood of progression to osteoarthritis, and/or (4) improve outcomes for patients with active osteoarthritis.
- F. Development of interventions that reduce the level of damage to nucleic acids, proteins and lipids and the macromolecular complexes formed from these molecules, and improve the damage surveillance and repair potential of cells.
- G. Development of tools and resources in genetics and genomics to study molecular mechanisms of normal aging or aging-related diseases.

#### **Division of Geriatrics and Clinical Gerontology**

- A. Development of clinical decision-support tools able to broadly integrate into the electronic health record to help physicians/providers caring for patients with multiple (3 or more) chronic conditions prioritize, coordinate, and deliver the interventions that are most beneficial and relevant within the context of these patients' lives and the health-care-delivery system.
- B. Projects focusing on translation/development of new therapeutic interventions to promote wound healing, improve vaccine response/immune function, and for physical functional problems in old age
- C. Development of assistive technologies/robotics to enable and support older persons to live independently and safely at home; socially-assistive robots; robots for caregiver and mobility assistance; robots for exercise and rehabilitation assistance.
- D. Development of technologies/robotics to assist in the improvement of physical function and mobility in older persons prior to (prehabilitation) or following (rehabilitation) elective/planned surgery.
- E. Development and validation of improved approaches for evaluation, monitoring or treatment of diastolic dysfunction in older adults
- F. Development of improved instrumentation/ imaging and sensor technology for measuring ambulation and biomechanics of movement including balance, sway, gait, and postural control to identify stable and unstable patterns of movement during activities of daily living
- G. Development of methods and technology to accurately determine the renal glomerular filtration rate (GFR) in older persons and patients with chronic kidney disease; new methods and technology should accommodate the effects of age-related changes in muscle mass, levels of serum creatinine, renal blood flow and renal concentrating ability.
- H. Development and validation of non-invasive methods of examining bone quality (density, architecture, and strength of bone).
- I. Development and validation of instruments and/or methods to evaluate fatiguability—the level of fatigue related to the intensity, duration, and/or frequency of activity (in contrast to measures of fatigue), particularly in adults with or at-risk of developing age-related conditions or diseases leading to physical disability.
- J. Development and validation of innovative approaches to pain control that considers age-related physiologic changes such as gastrointestinal absorption, cutaneous integrity, and musculoskeletal structure and function.

- K. Development and validation of new technology such as non-invasive methods to examine blood-flow velocity in arteries, individual coronary arteries, renal arteries, and cerebral arteries

#### **Division of Neuroscience (DN)**

- A. Development of new and/or validation of existing sensitive, specific and standardized tests for diagnostic screening of MCI and dementia; for example, the development of novel neuropsychological, biochemical, and neuroimaging technology and/or methods or the validation of existing measures/methods/technology for the early detection of cognitive impairment and MCI and the early diagnosis of AD and other dementias, and development of new technology and tests for detection of pre-clinical AD and other dementias of aging.
- B. Discovery, development, and/or evaluation of compounds, drugs, biological or natural products, including central-nervous-system delivery systems to remediate age-related cognitive decline, and to treat the cognitive impairment and/or behavioral symptoms associated with MCI, AD, and other dementias of aging as well as to slow and/or reverse the course of the disease or to prevent it entirely.
- C. The development of practical applications using innovative technologies (e.g. hand-held, internet, telemedicine GPS, robotics, social networking and communications technologies) to support and improve quality of life, well-being, and the ability of people with age-related cognitive decline, MCI, AD or other dementias of aging to live independently and safely at home for an extended period of time; examples include systems and devices to: evaluate, monitor and improve or adapt to changes in cognition; improve health service delivery; support independent living and the conduct of everyday tasks at home; provide information to health care providers and family members with which to evaluate the need for intervention; and promote communication and interaction between individuals living in the community or in institutional settings and their health care providers, friends and family members.
- D. Testing in clinical trials of drug, nutritional, behavioral, cognitive or other types of interventions to remediate age-related cognitive decline, and to treat cognitive impairment and/or behavioral symptoms associated with MCI, AD, and other dementias of aging as well as to slow and/or reverse the course of disease or to prevent the onset of disease.
- E. Biosensors and prosthetic devices, technologies, and related software development to aid in the assessment, diagnosis, and remediation of age-related cognitive decline or sensory dysfunction (including pain, age-related vision loss, and age-related hearing loss), motor dysfunction (including Parkinson's disease and other motor disorders of aging), or age-related changes in balance, postural control, and gait.
- F. Development of novel markers of normal age-dependent cognitive decline or sensory and/or motor system changes at the molecular cellular, circuitry, physiological or behavioral level in humans or relevant animal models.
- G. Improved technology for the analysis of structural and functional brain connectivity at the cell, neural circuitry and global network levels to define the normal trajectory of brain structure and function over the adult lifespan.
- H. Development of technology, including non-invasive methods and novel probes, to monitor and manipulate the plasticity of neural circuits in the adult and aged nervous system.
- I. Development of novel markers of neural stem cell function (proliferation, migration, and differentiation) as well as methods to assess the integration and function of stem cells in the nervous system.

J. Novel approaches for analysis of next-generation sequence data.

## **NATIONAL INSTITUTE ON ALCOHOL ABUSE AND ALCOHOLISM (NIAAA)**

### **A. Treatment of alcoholism**

- Pharmacological discovery, strategies, and development
- Innovative therapeutic approaches
- Prevention strategies
- Therapies for co-morbid conditions, including organ damage

### **B. Technology development to support screening, brief intervention, and referral to treatment for alcohol-involved patients in medical settings**

### **C. Development of novel technologies or methods**

- To detect the effects of alcohol on CNS structure and activities
- To prevent harmful drinking during pregnancy, to identify prenatal alcohol exposure, and to enhance outcomes of individuals with Fetal Alcohol Spectrum Disorder
- Tools for alcohol-related laboratory studies, such as animal strains, cell lines, stem cells, in vitro techniques, neuroimaging, ligands, in vivo detection of neuromodulators, or computational tools
- Stem cell generation, dissemination, and model development
- Voice technology, cell phones, and other

### **D. Development of Biomolecular Signatures of Alcohol Exposure and Alcohol-induced Tissue Injury**

### **E. Development, Optimization, and Validation of Novel Tools and Technologies for Neuroscience Research**

### **F. Design, Development, and Improvement of Alcohol Biosensors**

### **G. Investigational New Drug (IND)-enabling Development of Medications or Devices to Treat Alcohol Use Disorder and Alcohol-related Disorders**

### **H. Genotyping of DNA samples from subjects with addiction and substance use disorders**

# **NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES (NIAID)**

## **Division of Allergy, Immunology, and Transplantation (DAIT)**

A. Allergy, Asthma and Airway Biology Branch will consider preclinical and clinical research for conditions of interest: asthma, food allergy, eosinophilic esophagitis and gastroenteritis in relation to food allergy, atopic dermatitis, urticaria, rhinitis, rhinosinusitis, drug allergy, and sepsis. This includes but is not limited to the development of methodologies to manage, and analyze clinical and epidemiologic research in the above conditions and the development of biomarkers as diagnostic markers, markers of disease severity, predictive markers for treatment effectiveness, particularly of immunologic interventions such as allergen immunotherapy for food and respiratory allergy; novel approaches for detecting infants at risk for developing asthma and other allergic diseases; immune targets for asthma and allergic disease interventions; development of immunotherapies to prevent or treat allergic diseases; development of new reagents and non-murine animal models for allergy research.

B. Basic Immunology Branch will consider preclinical and clinical research to develop the origin, maturation, and interactions of immune cells, immune cell receptors, ligands, cytokine biology, molecular basis of activation, antigen recognition, immune tolerance, immune response regulation, hematopoiesis and stem cell biology, enhancement of vaccine effectiveness in neonates and adults, and basic immunology of vaccines and immunotherapeutics as medical countermeasures for biodefense. This includes but is not limited to development of novel vaccine adjuvants; single cell assays to isolate and study allergen-specific lymphocytes; immunotherapeutic antibodies; biomarkers of host immune defense; single cell and other sample-sparing assays for study of human immunology.

C. Autoimmunity and Mucosal Immunology Branch will consider preclinical and clinical research to develop and improve therapies for the treatment of autoimmune diseases, primary immune deficiencies (not HIV), basic research of disease mechanisms, and biomarkers, immunotherapy of disease processes, disorders mediated by lymphocyte products, and mucosal immunity. This includes but is not limited to innovative treatments for autoimmune diseases; standardized validated diagnostic criteria and outcome measures for autoimmune diseases correlated with disease activity; high throughput assay of T-cell activity in autoimmune diseases; biomarkers to measure risk, disease activity, and therapeutic response in autoimmune diseases; innovative treatments for autoimmune diseases; mucosal immunity.

D. Transplantation Branch will consider preclinical and clinical research in organ, vascularized composite tissue and cellular transplantation: acute and chronic graft rejection, allogeneic and xenogeneic transplantation, development of immunomodulatory agents to prevent and treat graft rejection and to promote acute and long term graft acceptance and immunologic tolerance, genomics of the alloimmune response, graft versus host disease and engraftment for hematopoietic stem cell transplantation, minor histocompatibility antigens, complications of immunosuppression in transplantation, and major histocompatibility complex (MHC) region genomics and technologies for MHC typing. This includes but is not limited to methods and analysis tools to facilitate high throughput, high resolution MHC typing in humans and non-human primates.

E. Radiation Countermeasures Program will consider preclinical research on the identification and evaluation of medical countermeasures (MCMs) for public health radiation emergencies through the development of mitigators and therapeutics for acute radiation syndrome or the delayed effects of acute radiation exposure; radionuclide-specific therapies, including chelating agents, blocking agents, and other novel decorporation agents; improved methods of accurate and high-throughput radiation biodosimetry and bioassays for radionuclide contamination; biomarkers of organ-specific radiation injury; therapeutics for radiation combined injury; therapeutics for radiation-induced immunosenescence; and formulations for pediatric administration. This includes but is not limited to the development of medical countermeasures to protect against, mitigate, and treat the short- and long-term effects of radiation exposure due to terrorist attack; development of novel or improved decorporation agents to remove radionuclides from the body following accidental inhalation, ingestion or wound entry; identification of radiation exposure biomarkers and development of new biodosimetry methods and devices for triage of radiation-exposed people.

## **Division of Microbiology and Infectious Diseases (DMID)**

- A. Identify and qualify infectious disease-related biomarkers, including:
  - 1. Biomarkers to predict susceptibility to infection and/or diagnose an infectious disease.
  - 2. Biomarkers to predict or monitor a subject's response to therapeutics or vaccinations.
  - 3. Biomarkers from natural history studies that could be used to assess disease progression in acute and chronic diseases.
- B. Development of rapid, highly sensitive and specific clinical diagnostics that are easy to use, cost-effective and can diagnose individuals infected with pathogens or individuals that have been exposed to toxins.
- C. Development of vaccines for infectious diseases.
- D. Development of vaccine enhancement and formulation technologies with the goal of providing protection against infectious disease agents, providing accelerated immune responses (more rapid schedules or reduced number of immunizations), increase ease of administration (i.e., self-administration), and increase product stability to minimize cold chain requirements.
- E. Discovery and development of therapeutics for infectious diseases.

## **Division of AIDS (DAIDS)**

- A. Development of anti-HIV agents directed at new viral or cellular targets, including development and in vivo evaluation of sustained release formulations for treatment of HIV infection.
- B. Development and evaluation of therapeutic vaccines and other immune-based therapies to attenuate HIV disease progression or reduce HIV infectiousness.
- C. Development of therapeutic strategies for curing HIV infection or effecting a sustained remission in the absence of daily antiretroviral drug therapy.
- D. Development of methods for detecting and quantifying persistent reservoirs of replication competent latent HIV in blood and tissues, including bio-imaging.
- E. Development and evaluation of practical and affordable tests to measure viral load, CD4+ cell counts, drug toxicities and drug resistance to monitor populations infected with HIV and associated infectious agents in resource-poor settings. Development of tests to detect early infection in seropositive HIV-infected individuals and to determine HIV incidence (HIV infection before seroconversion).
- F. Discovery and development of agents or strategies for Pre-exposure prophylaxis (PrEP). Development of pharmacological tools to examine PK/PD in fluids and tissue, new formulation and delivery systems for coitally-dissociated use, and optimization of animal models for screening of candidate agents.
- G. Development of rapid tests for the detection of ARTs in various human matrices (e.g. blood, urine, hair).
- H. Formulation, manufacturing, characterization and evaluation of novel vaccine adjuvants.
- I. Evaluation of immune responses to HIV vaccines and vaccine vectors.
- J. Development of formulation technologies to prevent or treat HIV and HIV-associated co-infections.

## **NATIONAL INSTITUTE OF ARTHRITIS AND MUSCULOSKELETAL AND SKIN DISEASES (NIAMS)**

- A. Research and development of new therapies using small molecules or biologics for arthritis, musculoskeletal and skin diseases.
- B. Research and development of novel biomedical devices or tissue engineered products for arthritis, musculoskeletal and skin diseases.
- C. Research and development of new biomarkers or novel imaging technologies for arthritis, musculoskeletal and skin diseases.
- D. Research and development of innovative internet-based technologies to manage arthritis, musculoskeletal and skin diseases.



## NATIONAL INSTITUTE OF BIOMEDICAL IMAGING AND BIOENGINEERING (NIBIB)

- A. **Image-Guided Interventions.** Research on use of images for guidance, navigation and orientation in minimally invasive procedures to reach specified targets. Examples include image-guided interventions for minimally invasive therapies such as surgery and radiation treatment, for biopsies, and for the delivery of drugs, genes and therapeutic devices.
- B. **Magnetic Resonance Imaging and Spectroscopy.** Development of MR imaging and MR spectroscopic imaging, for both animal and human research, and potential clinical applications. Examples include (but are not restricted to) fast imaging, high field imaging, design of novel RF and gradient coils, novel pulse sequences, design of novel contrast mechanisms, imaging informatics, *in vivo* EPR imaging, molecular imaging, etc. The emphasis should be on technological development rather than detailed applications to specific diseases or organs.
- C. **Medical Devices and Implant Science.** Design, development, evaluation and validation of medical devices and implants. This includes exploratory research on next generation concepts for diagnostic and therapeutic devices; development of tools for assessing host-implant interactions; studies to prevent adverse events; development of predictive models and methods to assess the useful life of devices; explant analysis; improved *in vitro* and animal models for device testing and validation.
- D. **Micro- and Nano-Systems, Platform Technologies.** Development of BioMEMS, microfluidics and nanoscale technologies, including micro-total analysis systems, arrays, and biochips, for detection and quantitation of clinically relevant analytes in complex matrices. Application areas include biomedical research, clinical laboratory diagnostics, biodefense, high-throughput screening, drug delivery, tissue engineering, and implantable devices, among others.
- E. **Optical Imaging and Spectroscopy.** Development and application of optical imaging, microscopy, and spectroscopy techniques; and development and application of optical imaging contrasts. Examples of research areas include fluorescence imaging, bioluminescence imaging, OCT, SHG, IR imaging, diffuse optical tomography, optical microscopy and spectroscopy, confocal microscopy, multiphoton microscopy, flow cytometry, development of innovative light sources and fiber optic imaging devices.
- F. **Telehealth.** Development of software and hardware for telehealth studies that have broad applications as well as early stage development of telehealth technologies that may have specific focus areas. Research that is supported includes methods to address usability and implementation issues in remote settings, and methods to develop technology for standardizing and incorporating state of the art security protocols for verifying user identities and preserving patient confidentiality across remote access.
- G. **Tissue Engineering and Regenerative Medicine.** Development of enabling technologies including real-time, non-invasive tools for assessing the function of engineered tissues; real-time assays that monitor the interaction of cells and their environment at the molecular and organelle level; predictive computational models for engineering function 3D tissues; high-throughput assays and instruments to reduce the cost, time, and complexity of tissue engineering; novel bioreactor techniques for expanding stem cells and growing tissues and organs on a large scale; and strategies for preserving, sterilizing, packaging, and transporting living-tissue products. The program also supports applications of rational engineering design principles to functional engineered tissues; the development of novel biomaterials for use as tissue scaffolds that mimic the extracellular matrix and support multiple cell types in defined spatial orientation; and engineering approaches to study how biomaterials interact with cells and guide cell growth, differentiation, and migration.
- H. **Ultrasound.** Improvement of technologies for diagnostic, interventional and therapeutic uses of ultrasound. The diagnostic ultrasound program includes, but is not limited to the design, development and construction of transducers, transducer arrays, and transducer materials,

innovative image acquisition and display methods, innovative signal processing methods and devices, and optoacoustic and thermoacoustic technology. It also includes the development of image-enhancement devices and methods, such as contrast agents, image and data presentation and mapping methods, such as functional imaging and image fusion. The interventional ultrasound program includes the use of ultrasound for therapeutic use, or as an adjunct for enhancement of non-ultrasound therapy applications. Examples include, but are not limited to, high-intensity focused ultrasound (HIFU) as a non-invasive or minimally invasive interventional surgical or therapy tool, and as an adjunct interventional tool. It also includes the use of ultrasound contrast agents for therapy and for targeted drug delivery, and the use of ultrasound for image-guided surgery, biopsy, and other interventions.

# ***EUNICE KENNEDY SHRIVER* NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT (NICHD)**

## **Child Development and Behavior Branch**

- A. Development and evaluation of serious games for bullying, with a particular interest in games that address cyberbullying are encouraged. Examples include but are not limited to games that address issues such as raising awareness of bullying, preventing engagement in bullying, and helping youth who are being bullied cope, problem solve and identifying support or resources to help address the situation.

## **Contraceptive Discovery and Development Branch**

- A. Contraception.

## **Developmental Biology and Structural Variation Branch**

- A. Innovative technologies for imaging developmental processes and gene expression; technologies for gene manipulations and perturbations.

## **Fertility and Infertility Branch**

- A. Development of novel techniques for assessment of gamete quality.

## **Gynecologic Health and Disease Branch**

- A. Development of innovative technologies for the treatment of pelvic floor dysfunction including pelvic organ prolapse, urinary incontinence or fecal incontinence.

## **Intellectual and Developmental Disabilities Branch**

- A. Technology development to improve screening, diagnosis and treatment of intellectual and developmental disabilities.

## **Maternal and Pediatric Infectious Disease Branch**

- A. New technologies relevant to resource-limited countries for point of care diagnosis of HIV and other infectious diseases, including tuberculosis, viral hepatitis, other congenital infections such as cytomegalovirus, respiratory infections, etc., in infants, children and pregnant/breastfeeding women.

## **Obstetric and Pediatric Pharmacology and Therapeutics Branch**

- A. Development of nanosized formulations to optimize efficacy and minimize toxicity of pediatric drugs

## **Pediatric Growth and Nutrition Branch**

- A. Isolation, purification and synthesis of human milk oligosaccharides with antimicrobial activity.

## **Pediatric Trauma and Critical Illness Branch**

- A. Research and development of devices and innovative therapeutic technologies for management of physical disabilities and related problems stemming from and acute injuries.

## **Population Dynamics Branch**

- A. Technological innovations or inventions to improve collection of biomarker data in large population-representative surveys.

**Pregnancy and Perinatology Branch**

- A. Devices, instruments, and tools to minimize bacterial colonization, reduce proclivity for thrombous formation; reduce health-care associated infection risks.

**National Center for Medical Rehabilitation Research**

- A. Development of medical rehabilitation interventions and biomedical technologies to improve rehabilitation treatment for restoration of function.

## **NATIONAL INSTITUTE ON DEAFNESS AND OTHER COMMUNICATION DISORDERS (NIDCD)**

- A. Research and development for biomedical technologies (medical devices, diagnostic instruments, pharmaceuticals, drugs, therapeutics, vaccines, and biologics) that require review and approval by the FDA as a regulated product before commercial distribution.

# **NATIONAL INSTITUTE OF DENTAL AND CRANIOFACIAL RESEARCH (NIDCR)**

## **Infectious Diseases and Immunity**

- A. Develop oral topical formulations with combined microbicidal, analgesic, and anti-inflammatory activities to enhance oral mucosal defenses and prevent and/or control oral infections and lesions in HIV-infected and/or immunosuppressed subjects.

## **Clinical Research**

- A. Develop improved methods to detect and predict progression of dental caries, periodontal disease, reversible pulpitis and irreversible pulpitis.
- B. Improve or develop new methods to enhance oral and craniofacial surgery. This would include both intraoral and extraoral surgery.
- C. Develop improved methods to mechanically repair or treat tooth structure damaged by dental caries or periodontal disease.

## **Oral, Oropharyngeal and Salivary Gland Cancers**

- A. Develop regimens for the alleviation of the oral complications of cancer therapy.
- B. Develop imaging techniques for the early detection, diagnosis and prognosis of pre-malignant lesions.

## **Temporomandibular Joint Disorder and Orofacial Pain**

- A. Discovering and developing novel, pharmacological medications for treating chronic orofacial pain disorders, by leveraging results from ongoing genetic studies of chronic pain conditions

## **Saliva, Salivary Diagnostics, and Salivary Gland Diseases**

- A. Development of viral, non-viral and gene therapy-based approaches to address compromised salivary gland function. Development of cell and tissue-based strategies and technologies for restoration of damaged or destroyed salivary gland function.
- B. Development of novel compounds or materials that protect and preserve salivary glands from head and neck cancer irradiation therapy.
- C. Development of non-invasive methods for the determination of efficacy and safety of artificial saliva, sialogogues, and of their delivery vehicles used in addressing the diminution or lack of saliva (xerostomia) due to Sjögren's Syndrome or head and neck cancer irradiation therapy.
- D. Development of immunological strategies and immunotherapy-based approaches for addressing xerostomia from Sjögren's Syndrome.

## **Biotechnology, Biomaterials, and Applications for Regeneration and Restoration of Oral, Dental and Craniofacial Tissues**

- A. Development of methods, materials, and devices for orthodontic, prosthetic, and craniofacial applications including those that can be used for craniofacial bone distraction, craniofacial reconstruction, healing, and scarless repair.
- B. Development of imaging diagnostics to accelerate clinical implementation of reliable, reproducible, highly specific and sensitive diagnostic instruments for dental caries, cracked teeth, pulp vitality, bone quality, and periodontal diseases.

**Clinical and Behavioral Research**

- A. Develop and test for safety, efficacy, and/or effectiveness of measures or materials for diagnosing, preventing, or treating oral, dental, and craniofacial conditions and disorders.

## NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES (NIDDK)

NIDDK supports the topics below as they pertain to *Diabetes* (Type 1 and Type 2 Diabetes, Metabolic Disorders, Cystic Fibrosis, and Endocrine Disorders), *Digestive Diseases* (Gastrointestinal Diseases, Liver and Pancreatic Diseases, Obesity, Nutrition, and related diseases), and *Kidney Diseases* (Kidney Diseases, Urologic Diseases, and Hematologic Diseases).

- A. Development or evaluation of pharmacological agents (i.e., drugs, therapeutics), gene therapies, cell-based or other biological technologies for intervention in or prevention of *Diabetes and Digestive and Kidney Diseases*.
- B. Development or evaluation of biomedical devices, tools, or instrumentation for intervention in or prevention of *Diabetes and Digestive and Kidney Diseases*.
- C. Development of biomarkers, assays, diagnostic technologies or associated reagents for assessing state or function in normal, developing, or diseased cells or tissues affected by *Diabetes and Digestive and Kidney Diseases*.
- D. Development or evaluation of imaging, screening, or evaluation technologies for assessing state or function in normal, developing, or diseased cells or tissues affected by *Diabetes and Digestive and Kidney Diseases*.
- E. Development or evaluation of animal or cell models for studying *Diabetes and Digestive and Kidney Diseases*.
- F. Development or evaluation of novel materials or material treatments (e.g., sterilization, coating, etc.) for use in devices or other tools or methods used to prevent, diagnose, or treat *Diabetes and Digestive and Kidney Diseases*.
- G. Development of cell- or data-banks for the biomedical research community.
- H. Development or evaluation of technologies, including software applications, for improving patient adherence in *Diabetes and Digestive and Kidney Diseases*.
- I. Development or evaluation of technologies for improving clinical research in *Diabetes and Digestive and Kidney Diseases*, including technologies for improving data collection and reporting of patient outcomes.
- J. Development or evaluation of –omics, informatics, or internet-based technologies for biomedical research or clinical applications in diagnosing or managing *Diabetes and Digestive and Kidney Diseases*.
- K. Development or evaluation of technologies to prevent or avert cell or tissue injury during other disease states or surgical procedures.



## **NATIONAL INSTITUTE ON DRUG ABUSE (NIDA)**

- A. Drug discovery and development-enabling activities: Development of innovative technologies, methods or tools, including but not limited to:
  - 1. Innovative in vitro, in situ, or in vivo tools for the molecular analysis of the central nervous system, normal and/or diseased.
  - 2. Tools to simplify drug design through the use of advanced computing (simulation) methods.
  - 3. Novel analytical technologies and methods that enhance the understanding of basic mechanisms of drug action and improve drug testing; technologies designed to overcome the performance limitations of current drug discovery and development tools.
  - 4. Technologies, including molecular imaging, gene expression profiling, and genotyping and sequencing approaches designed to better inform the diagnosis and treatment of substance use disorders
- B. Drug discovery and development activities: Application of emerging and existing technologies and platforms to Substance Use Disorder (SUD) drug development. Medical products with potential to minimize drug seeking, compulsive behavior, and/or addictive processes. Examples might include, but are not limited to:
  - 1. Chemistry / pharmaceutical drug development
  - 2. Formulation and/or enhanced delivery of drugs
  - 3. Preclinical and/or clinical drug development
  - 4. Identification and development of biomarkers related to SUD treatment outcomes

## **NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES (NIEHS)**

- A. Development and validation of alternative test methods to protect human and animal health while reducing, refining, or replacing animal tests.

# **NATIONAL INSTITUTE OF GENERAL MEDICAL SCIENCES (NIGMS)**

## **Division of Cell Biology and Biophysics**

- A. Development of instrumentation, devices, and methods for detecting in real time, analyzing, and separating biologically important compounds, macromolecules, and their interactions.
- B. Development of new methods and materials directed toward the solution of biological macromolecule structures, including membrane proteins, assemblies and complexes by, but not limited to, x-ray diffraction, electron diffraction, NMR and mass spectroscopy.
- C. Imaging probes and sensors, other reagents and methods, instrumentation, software for microscopy, spectroscopy, and single molecule analysis of molecules, cells, tissues, embryos and small model organisms. Technologies for applications of microscopy, spectroscopy and single molecule analysis in basic biomedical research, including but not limited to light, electron, X-ray and scanning probe microscopy and fluorescence, magnetic and electron paramagnetic spectroscopy. NOT included are small animal and preclinical imaging and high throughput platforms for diagnostic and clinical applications.
- D. Development of high-throughput and computational methods and strategies to define/characterize the function and interactions of biological macromolecules and cells.

## **Division of Genetics and Developmental Biology**

- A. Development of probes for detection of human genetic polymorphisms, including disease genes.
- B. Development of valid animal models for genetic diseases and birth defects.
- C. Development of tools and technologies to detect and monitor complex human phenotypes or traits.
- D. Development or improvement of methods for high throughput detection of epigenomic changes.E. Development of improved technology, reagents and tools to derive, grow, isolate, differentiate and characterize cells.

## **Division of Pharmacology, Physiology, and Biological Chemistry**

- A. Methods for isolation, characterization, and production of natural and bio-engineered products.
- B. Development of methodology to improve the efficiency of discovery, development, and production of bio-medically relevant compounds.
- C. Isolation, characterization, and development of factors and strategies, methods, or treatments involved in tissue repair, wound healing, sepsis, and traumatic injury, emergency, peri-operative, or critical care conditions, and associated pain management.
- D. Research to improve drug design and delivery.
- E. Development of technologies, including instrumentation, software, reagents, and methods for proteomics, including but not limited to robotics, sample preparation and pre-fractionation, analytical separations, mass spectrometry, intelligent automated data acquisition, and improved informatics technologies.
- F. Development of technologies, including instrumentation, software, reagents, and methods for glycomics, including but not limited to development of: specific glycan structural databases,

methodologies for synthesis of robust glycan libraries, glycan labeling reagents and glyco-enzyme inhibitors, and analytical tools for determining carbohydrate structure and biological function..

**Division of Biomedical Technology, Bioinformatics, and Computational Biology**

- A. Development of instrumentation and devices for detection, analysis and separation of biologically important molecules, and for elucidating their interactions both in vitro and intra-cellularly.
- B. Development of information and communication technology from computer and other quantitative sciences in support of biomedical or behavioral research, that apply best practices and proven methods for software design, construction and implementation to promote adoption by a broad biomedical research community.

## **NATIONAL INSTITUTE OF MENTAL HEALTH (NIMH)**

### **All divisions:**

- A. Preclinical drug/device development studies, including pharmacology, efficacy and toxicology.
- B. Completion of studies as required by the Food and Drug Administration (FDA) for Investigational New Drug (IND) or Radioactive Drug Research Committee (RDRC) application.
- C. Studies in normal healthy volunteers to determine a drug's safety profile, metabolism, etc.
- D. Clinical studies in patient/disease population to assess the drug's effectiveness.
- E. Assessment of devices with regard to performance standards related to the FDA approval process.
- F. Safety and effectiveness studies of novel medical devices.
- G. Evaluation of novel imaging approaches for diagnostic purposes.
- H. Clinical studies in support of Pre-Market Approval for biomarkers/medical devices by the FDA.
- I. Rapidly develop novel, engaging computer-based cognitive training programs that are based on efficacious neurotherapeutic approaches and which use cognitive training to target a specific neural system/functional domain.
- J. Augment existing computerized cognitive interventions to be personalized, engaging, adaptive, sufficiently challenging, and optimal for maximizing real world functional improvements.
- K. Test the feasibility, efficacy and potential adverse effects of these programs utilizing measures of functional outcomes in an identified clinical population, particularly those with neuropsychiatric disorders, ASD, and/or HAND, at a specified developmental stage, including measurement of the duration of treatment effects
- L. Rapid development and evaluation of mobile based platforms and applications.

### **Division of Neuroscience and Basic Behavioral Science (DNBBS)**

- A. Novel imaging probes to study brain structure and function at all levels, from the molecular to the whole organ, using any imaging modality (PET, fMRI, optical, etc.).
- B. Drug discovery/drug development of novel compounds which act on molecular pathways (receptors, enzymes, second messengers, etc.) that are not typically targeted with currently available psychiatric drugs, and that have a strong biological justification as a novel mechanism for treatment of psychiatric disorders.
- C. Novel screening assays for high throughput acquisition and analysis of data about behavior and the brain, from the level of genes to the level of behavior.
- D. Novel technologies that would enable researchers to study how populations of neural cells work together within and between brain regions, in order to understand how changes in neural activity contributes to mental disorders.
- E. Complex instrumentation for neuroscience research
- F. Complex brain or cellular imaging or analysis.

- G. Tools to facilitate the detailed analysis of complex circuits and provide insights into cellular interactions that underlie brain function.
- H. Proof-of-concept testing and development of new technologies and novel approaches for large scale recording and manipulation of neural activity, at or near cellular resolution, at multiple spatial and/or temporal scales, in any region and throughout the entire depth of the brain
- I. Iterative refinement of such tools and technologies with the end-user community with an end-goal of scaling manufacture towards reliable, broad, sustainable dissemination and incorporation into regular neuroscience practice.
- J. Novel informatics tools to facilitate the sharing of complex data sets between laboratories.
- K. Novel tools for investigating brain-derived GPCRs in mental health research.

#### **Division of Developmental Translational Research (DDTR)**

- A. Develop, test and validate reliable and stable biomarkers that can identify at-risk individuals prior to disease onset, improve diagnosis, predict treatment response, or measure disease progression. Biomarkers are also needed in clinical trials to identify dose ranges, to identify a specific subpopulation of subjects to enroll in a treatment trial, or to measure efficacy or toxicity/side effects.
- B. Develop novel and targeted interventions (pharmacological, cognitive, behavioral, computer, or device-based) that affect particular neural circuits and signaling pathways relevant to the developmental trajectory of the disease.
- C. Based on expanded knowledge of neurobehavioral trajectories, develop novel objective assessment tools that can identify early signs of risk or onset of recurrence of particular mental disorders or in domains of functioning (see MH's RDoC project: <http://www.nimh.nih.gov/research-funding/rdoc/index.shtml>) for pediatric populations.
- D. Develop computational behavioral assessment tools that can be used across ages, species, and cultures to evaluate dysfunction in domains relevant to mental disorders (e.g., mood dysregulation, deficits in executive function).
- E. Develop computational platforms to enable the integration and sharing of data characterizing typical and atypical developmental trajectories in humans and non-human animals.
- F. Clinical research tools.

#### **Division of Adult Translational Research and Treatment Development (DATR)**

- A. Develop valid measures of the various constructs in the Research Domain Criteria (RDoC) matrix (see <http://www.nimh.nih.gov/research-funding/rdoc/index.shtml> ), e.g., neurocognitive tasks, psychometrically sophisticated questionnaires, measures of behavior, and biomarkers, into a commercial product.
- B. Conduct early stage, proof of concept clinical trials to advance the development of novel therapeutics. The clinical trials are expected to include biological/behavioral data to assess target engagement and to help determine potential success or failure of the compound before moving

on to larger clinical trials (see NOT-MH-11-015 <http://grants.nih.gov/grants/guide/notice-files/NOT-MH-11-015.html>).

- C. Develop, test and validate reliable and stable biomarkers that can identify at-risk individuals prior to disease onset, improve diagnosis, predict treatment response, or to measure disease progression. Biomarkers are also needed in clinical trials to identify dose ranges, to identify a specific subpopulation of subjects to enroll in a treatment trial, or to measure efficacy or toxicity/side effects.
- D. Develop clinical risk assessment instruments that encompass multiple domains (e.g., genetic, neurobiological, and environmental), are sensitive to developmental stage, and have high predictive power for the onset or recurrence of mental illness.
- E. Develop novel and targeted interventions (pharmacological, behavioral, or devices) that affect particular neural circuits and signaling pathways relevant to the developmental trajectory of the disease.
- F. Develop electronic sensors, monitoring devices and systems, and data analysis software for automated detection and diagnosis of mental disorders and key transdiagnostic dimensions of psychopathology.
- G. Develop risk assessment measures, methods and paradigms capable of evaluating individualized risk for developing mental disorders, or for developing particular benefits or harms during treatment for mental disorders, and communicating such probabilistic information to patients and their families in a readily understandable manner.
- H. Clinical research tools.

#### **Division of AIDS Research (DAR)**

- A. Develop and test novel, non-invasive diagnostic approaches (instrumentation, imaging, biomarkers, central nervous system [CNS] cell-based *in vitro* models) to detect neurocognitive dysfunction associated with HIV-1 infection and innovative technologies to study the mechanisms involved in HIV-1 associated neuropathogenesis and persistence of HIV-1 in the CNS or strategies to prevent viral resurgence in the CNS upon cessation of anti-retroviral therapy.
- B. Design and test novel therapeutic strategies aimed at amelioration of HIV-1 associated neurocognitive disorders (HAND) and eradication of HIV-1 from CNS reservoirs or strategies to prevent viral resurgence in the CNS upon cessation of anti-retroviral therapy.
- C. Discover and develop innovative technologies for targeting therapies to the brain, including antiretroviral drugs, nanotechnology, imaging tools to study HIV-aging interactions or HIV-related neurodegeneration and neuroprotective strategies with improved capability to cross the blood-brain barrier for amelioration of HAND.
- D. Design new strategies to reduce adverse effects of anti-retroviral drugs such as neuropsychiatric side effects and drug-drug interactions.
- E. Develop or adapt neurological/neuropsychological/neurobehavioral assessments to evaluate HIV-1 associated abnormalities in adults or children in resource poor environments that are adaptable to different cultures and languages.
- F. Develop innovative approaches to improve the scientific assessment of HIV sexual risk behavior or medication adherence through wireless technologies, remote sensing devices, biomarkers, or other novel methods..

- G. Develop and test tools, curricula, and strategies that seek to reduce documented racial/ethnic, gender, and age-related disparities in HIV infection or in HIV treatment adherence and treatment outcomes.
- H. Develop novel tools and approaches to identify, recruit, enroll, and/or retain those most vulnerable to HIV/AIDS (e.g., African-American MSM, adolescents) in HIV prevention research and/or initiatives.
- I. Develop and test tools, curricula, or other approaches designed to facilitate the effective implementation of emerging biomedical HIV prevention methods (e.g., pre-exposure prophylaxis, microbicides, circumcision, etc.), including but not limited to approaches that address behavioral aspects of biomedical prevention (e.g., provider knowledge and training; patient uptake, adherence, HIV screening, and risk-reduction counseling; adverse event monitoring, etc.).
- J. Develop or adapt and evidence-based HIV sexual risk reduction, psychosocial coping, or treatment adherence interventions for delivery through the internet or mobile devices, with the aim of expanding intervention access, fidelity of delivery, and/or intervention tailoring.
- K. Develop novel tools and approaches designed to improve HIV treatment outcomes by rapidly linking individuals diagnosed with HIV to primary medical care, enhancing patient readiness for initiation of antiretroviral medications, improving and sustaining patient adherence to antiretroviral medications, and/or improving patient retention in medical care.
- L. Develop innovative approaches designed to improve the quality of HIV testing, (including rapid home based HIV antibody tests), HIV counseling, prevention, and treatment services by strengthening patient-provider communication and/or modifying the decision-making processes and practice behaviors of health care providers.
- M. Develop innovative approaches designed to improve the uptake and understanding of rapid home based HIV antibody tests by key populations at higher risk for HIV as well as innovative interventions that can be paired with home test kits to increase linkage and engagement in HIV care for those testing positive.
- N. Develop novel information technology tools designed to improve dissemination of evidence-based interventions and assist healthcare providers, community-based organizations, and professional or advocacy organizations in identifying, adopting, and implementing proven HIV prevention and treatment interventions.

#### **Division of Services and Intervention Research (DSIR)**

- A. Randomized clinical trials evaluating the effectiveness of known efficacious interventions.
- B. Analyses of naturalistic databases to evaluate the effectiveness of known efficacious interventions.
- C. Identifying moderators and mediators of intervention effects as a step to design and test personalized interventions.
- D. Evaluating the combined or sequential use of interventions.
- E. Determining the optimal length of intervention, establishing the utility of continuation or maintenance treatment (that is, for prevention of relapse or recurrence).
- F. Evaluating the long-term impact of efficacious interventions on symptoms, functioning, and quality of life.



**Services research covers all mental health services research issues across the lifespan and disorders, including but not limited to:**

- A. Services organization, delivery (process and receipt of care), and related health economics at the individual, clinical, program, community and systems levels in specialty mental health, general health, and other delivery settings (such as the workplace).
- B. Interventions to improve the quality and outcomes of care.
- C. Enhanced capacity for conducting services research.
- D. The clinical epidemiology of mental disorders across all clinical and service settings.
- E. The dissemination and implementation of evidence-based interventions into service settings.

## **NATIONAL INSTITUTE ON MINORITY HEALTH AND HEALTH DISPARITIES (NIMHD)**

- A. Telehealth technologies for remote diagnosis and monitoring.
- B. Telemedicine to improve access to specialty care which would normally not be accessible because of high cost and transportation. This would also link up academic tertiary-oriented health centers with community-based primary care homes.
- C. Use of currently available technology (e.g. phone lines, televisions with remote controls, cellphones, weight scales, diabetic glucometers, thermometers) within underserved settings to provide self-management and patient education, increase patient-clinician communication and surveillance of chronic disease conditions.
- D. Improved early detection (via saliva testing, breath testing, blood testing) of diseases where there are significant health disparities.

## NATIONAL INSTITUTE OF NEUROLOGICAL DISORDERS AND STROKE (NINDS)

The NINDS accepts a broad range of small business applications that are significant, innovative, and relevant to its mission. Examples of research topics within the mission of NINDS are shown below. This list is not all inclusive and some research areas fall into multiple categories.

1. Therapeutics and Diagnostics Development for Neurological Disorders, including biomarker and diagnostic assays, therapeutics (drugs, biologics, and/or devices) for treatment of neurological disorders, and technologies/methodologies to deliver therapeutics to the nervous system.
2. Clinical and Rehabilitation Tools, including intraoperative technologies for neurosurgeons, rehabilitation devices and programs for neurological disorders, and brain monitoring systems
3. Technology and Tools, including technologies to image the nervous system, neural interfaces technologies, and tools for neuroscience research and drug development.

Within these research topics, the following research may require additional funds above the hard budget caps:

- A. *In vivo* animal testing required for therapeutics and diagnostics development.
- B. Drug and biologics preclinical discovery and development activities for regulatory submission, such as lead identification/optimization, preclinical efficacy testing, IND-enabling studies, and manufacturing for clinical trials.
- C. Device preclinical discovery and development activities for regulatory submission, such as hardware prototyping, device/software verification, biocompatibility/sterilization testing, pre-clinical efficacy testing, large animal GLP safety testing, and preparing material/devices for human testing.
- D. Clinical testing of therapeutics (drugs, devices, or biologics), diagnostics, clinical and rehabilitation tools (i.e. intraoperative technologies, rehabilitation devices and programs, and brain monitoring systems), and technologies for clinical research. This would include clinical research studies to test scientific hypothesis that are not feasible or practical to conduct in animal models but would inform a final device design.
- E. *In vivo* animal testing of technologies for animal research and development of animal models for drug development and neuroscience research.
- F. Research that requires special facilities to contain hazardous or infectious materials.

## **NATIONAL INSTITUTE OF NURSING RESEARCH (NINR)**

### **Research and Development of Technologies for Health Promotion and Alleviation, Adaptation to, or Management of Symptoms**

- A. Technologies to be used in the hospital, long-term care, hospice, assisted living facility, or home setting that improve symptom diagnosis, evaluation and management in persons with chronic conditions.
- B. Devices that improve the acceptance and use of assistive and monitoring devices.
- C. Devices to diagnose and screen for COPD early in the course of the disease, particularly targeting young adults.
- D. Technologies to assist in health promotion and prevention activities across the lifespan.
- E. Devices to assist in providing palliative care for patients with life threatening illnesses through the disease trajectory whether in active treatment or at the end of life.
- F. Technologies to assist individuals in reducing environmental exposures, i.e., chemical, bacterial and viral agents, and indoor/outdoor allergens.
- G. Devices to facilitate resource sharing such as: technologies that will enable valid and reliable measurement tools/instruments to be readily available and shared by research scientists focused on similar issues in a variety of populations.
- H. Adaptation of existing or development of new technologies that will link under-represented and/or underserved populations with available resources to sustain healthy life styles and eliminate health disparities.
- I. Devices to measure and monitor effect of physical activity on symptom improvement.

### **Research and Development of Technologies to Enhance Self Care and Clinical Care**

- A. Technologies to assist patients to adhere to chronic regimens such as reminding children to take steroid inhalers during the day for asthma; alerting obese adults when high calorie and fat content foods are about to be eaten; adhering to medication regimens; and prompting sedentary adults to exercise.
- B. Devices that improve delivery of care to persons who have restricted or impaired movement due to (1) conditions of neurological disease or injury, peripheral vascular disease, rheumatoid disease, or intractable pain, (2) life sustaining equipment, such as dialysis machines or left ventricular assist devices, or (3) orthopedic fixation devices.
- C. Devices to enable providers and or research scientists to monitor successful adherence to complex medication regimens (e.g., Highly Active Anti-Retroviral treatment).
- D. Technologies that monitor short and long term self-care behavior changes.
- E. Biological and behavioral monitoring devices for patients in at-risk and underserved populations in rural and frontier areas that will enable access to clinical care.
- F. Telehealth and mHealth technologies to improve patient outcomes through increasing quality, type, and speed of health information sharing, e.g., assessing traumatic injury severity at remote sites and transmitting this information to acute care settings for assessment and evaluation; communicating signs and symptoms of clients at home to health care providers in

distant locations; tailoring care for diverse patients in a wide variety of settings, and promoting community interventions to eliminate health disparities.

- G. Technologies to treat chronic wounds that fail to heal, specifically decubitus ulcers, venous stasis ulcers, and diabetic ulcers.
- H. Technologies to be used in the hospital or home care setting to monitor or assess preterm, low-birth weight or other high-risk infants.
- I. Technologies to assist informal caregivers in providing care or assistance to family members in the home.
- J. Noninvasive devices to assess exposure to chemical, bacterial and viral agents for children and adults and transmit this information to health care personnel for assessment and evaluation.
- K. Technologies to disseminate research information (i.e., biobehavioral responses, communication of risk, bioethics) to nurses practicing in emergency settings and in the community.
- L. Technologies and informatics-based solutions that promote health, including comprehensive high-throughput technologies.
- M. Develop and creatively apply new and existing knowledge to the implementation of health information technology, including electronic health records.
- N. Health care technologies to facilitate decision support, self-management, and access to health care.
- O. Utilization of genetic and genomic technologies to advance knowledge of the “symptome” including the biological underpinnings of symptoms associated with chronic illness.

#### **Other Research Topic(s) Within the Mission of the Institute**

- A. ***Micro- and Nano-Systems, Platform Technologies.*** Development of BioMEMS, microfluidics and nanoscale technologies, including micro-total analysis systems, arrays, and biochips, for detection and quantitation of clinically relevant analytes in complex matrices. Application areas include biomedical research, clinical laboratory diagnostics, biodefense, high-throughput screening, drug delivery, tissue engineering, and implantable devices, among others.
- B. ***Nanotechnology.*** Research and development of new enabling technologies for the fabrication and use of nanoscale components and systems in diagnostic and therapeutic applications. Examples include: development of new nanoscale patterning and manipulation systems; new approaches to the sensing and quantification of biologically important molecules using nanoscale specific properties; studies relating to the safety and commercialization of nanotechnology-enabled biomedical products.

## NATIONAL LIBRARY OF MEDICINE (NLM)

- A. Technology development and applications to improve storage, retrieval, access, management and use of biomedical knowledge
- B. Computational representation of biomedical knowledge
- C. Enhancement of human intellectual capacities through virtual reality, artificial intelligence, and machine learning
- D. *In silico* science
- E. Natural language understanding
- F. Support for health decisions
- G. Integration, organization and retrieval in very large databases, disparate forms of knowledge, and multiple datasets
- H. Investigations of topics relevant to health information science, computational modeling, and management of information during disasters

## **DIVISION OF PROGRAM COORDINATION, PLANNING, AND STRATEGIC INITIATIVES (DPCPSI), OFFICE OF RESEARCH INFRASTRUCTURE PROGRAMS (ORIP)**

### **RESEARCH AND DEVELOPMENT IN COMPARATIVE MEDICINE**

- A. Development of new technologies to rapidly phenotype large number of animals.
- B. Development of technologies to identify biomarkers for clinical diagnostics in well validated disease models.
- C. Development of vaccines and new therapeutic agents to prevent and/or control selected laboratory animal diseases. One high priority need is to develop methods to control and prevent Herpes virus B in nonhuman primates.
- D. Design of specialized equipment and caging for laboratory animals to permit optimal environmental control and operational efficiency, including improvements in caging and remote monitoring in animal facilities.
- E. Identification, development, and characterization of spontaneous and engineered vertebrate animal models for studies of various human diseases, excluding most random mutagenesis projects performed on rodents.
- F. Development and refinement of high throughput technologies and devices for the effective cryopreservation, long-term maintenance, and monitoring of stem cells and laboratory animal embryos, gametes, and their predecessors.
- G. Development of improved reagents, techniques, and equipment to perform, analyze, capture and process data gathered in “omics” studies (genomics, transcriptomics, phenomics, proteomics, glycomics, epigenomics, metabolomics) in normal and disease-condition animal models.
- H. Development of biological tools and reagents for reconstruction, remodeling, repair and regeneration of tissues damaged by injury or disease. Development of the technologies and procedures to test efficacy and safety of these experiments in animal models. Approaches to detect and track the implanted cells and tissues *in vivo*.
- I. Development of new technologies in animal/cell models to study the function (activation/silencing) of noncoding DNA or RNA regions in the development of diseases.
- J. Development of acellular biomaterials, biosensors and reagents to promote, detect and track reconstruction, remodeling, repair and regeneration of tissues damaged by injury or disease.

### **Other Research Topic(s) within the Mission of the Office of Research Infrastructure Programs**

- A. Development of methodologies, diagnostics, technologies, equipment, assay systems and portable devices that can be used in community settings, such as health centers, neighborhood clinics, doctor offices, public schools, libraries, and rural and remote locations to facilitate biomedical and behavioral research;
- B. Development of culturally appropriate educational materials for student, teacher and community health literacy and disease prevention/intervention such as: software, videos, printed material to facilitate translation and dissemination of evidence-based health information;
- C. Innovative applications of health information technology, including telemedicine/telehealth tools and technologies, to facilitate electronic health information exchange, enable clinical research at the point of care, and improve access to quality health care for hard to reach populations; and

- D. Development of Serious science, technology, engineering and mathematics (STEM) Games with a biomedical focus that will complement teacher professional development, improve student achievement, career aspirations and expand community health literacy.